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PATRICK BLACKETT IN INDIA: MILITARY CONSULTANT AND
SCIENTIFIC INTERVENOR, 1947–72. PART ONE

by

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SUMMARY

Invited to lunch at the Nehru home in January 1947, Patrick Blackett was seated beside the acting Prime Minister. Jawaharlal Nehru knew of Blackett's experience in war and military affairs, and asked him how long it would take 'to Indianize the military', meaning both its command structure and its weapons production and supply. He was not yet the Prime Minister and India was not yet an independent nation. Blackett's reply was a challenging one, obliging Nehru to explore two different kinds of strategy and thus two different military set-ups. For the 'realistic' strategy Blackett preferred, he told Nehru that Indianization could be completed in 18 months; this would prepare India for conflict with other similar powers in the region. For the unrealistic strategy, in which India would prepare for conflict with major world powers, Blackett predicted it would take many, many years. Nehru liked his approach, and wrote to him soon afterwards to ask Blackett to advise him on military and scientific affairs. From this invitation much followed.

In this paper, the first of two about Patrick Blackett in India, I examine the record from his perspective upon his work with and for the military. He was regularly in touch with military development in India between 1947 and roughly 1965, advising the Chiefs of Staff, the Minister of Defence and the Prime Minister himself. He carried with him the experience and opinions generated from his military career beginning in the First World War, and most particularly his assumptions about the application of science to war from 1935 until he went to India in 1947. He kept informed about military development right through to his last journey to India in 1971, following the end of his term as President of the Royal Society.

INTRODUCTION

In describing some of Blackett's activities in India and relationships with Indian leaders and their problems, my purpose is to convey—mostly in his own words—the problem, as he perceived it, and the solution he advocated. Through this we get an understanding of the changing context in which he worked, and the evolution of his

thought and practice as a consultant and intervenor.

Twenty years after he first set foot in that country, Patrick Blackett was thinking about his influence on military and scientific developments in India. In a free-ranging interview with B.R. Nanda in 1967, he selected his influence as military consultant as probably more important than his other roles as scientific intervenor.¹ This is in marked contrast to Indian perceptions of him, which focused mainly on his influence on large scientific research organizations. There is truth in both views, as I will show. But Blackett rightly points to his relationship with Prime Minister Jawaharlal Nehru as crucial to his influence in both spheres. Nehru identified with Blackett because both had been to Cambridge, held favourable attitudes to 'political' socialism, and were cautious about the same kinds of people, including 'the Americans'. In turn, Blackett acknowledges Nehru to be unusually receptive to his ideas and approaches, more receptive than his own British prime ministers of the period to 1964. What Blackett does not say is that Nehru acted on his ideas, not just because of Nehru's personal receptivity, but also because Blackett's ideas were acceptable to a handful of other influential people in India, namely the scientists Homi Bhabha and Sir Shanti Bhatnagar, and to a lesser extent D.S. Kothari and senior military officers like General J.N. Chaudhuri. Few of these people would have been untouched by Blackett's multitude of interests and torrent of energy, and would therefore have paid attention to his presence. But more importantly, Blackett articulated ideas they had, supported them in their efforts and made connections to people outside India for them. And finally, his influence coincided with and extended the work of his old Cambridge colleague A.V. Hill, who had been deeply involved in India since 1943 and continued to play a role among scientists similar to Blackett's. To this nexus of trusting and increasingly familiar relationships should be added the force of a number of material factors and ideas, making what Blackett said and did even more acceptable in elite Indian political and scientific circles.

This British expert became sought after precisely as the sun was setting on the Empire, as physics was taking a strategic turn, and as military development was becoming a national and commercial complex in which university-based scientists gradually played a more marginal role, particularly in contrast to Blackett's experience in Britain over the previous 10 years (that is from about 1938 to 1948). In 1947–50, when his reputation was deepening in India, the full consequence of the way the Second World War ended was evident. The British presence in India had to end, but did so too slowly for Britain's reputation in India. The Indian adjustment to the new world power, the USA, was complicated by the sudden emergence in 1947 of Pakistan. The USA was a major power in Asia too, with bases in Japan, Taiwan and the Philippines. When the first Soviet atomic bomb was exploded in 1949 (years before the old Allies predicted it), military bases in northern Pakistan acquired a new significance to Britain and America. When the victory of the Communist forces in China was finalized in 1949, a great arc of land from the Baltic to the Pacific, and diverse populations 'marching to a different drummer', lay to the north of India. The Anglo-American approach to India would have been complicated enough after 1947 without Pakistan, a Soviet bomb and a communist China. With these factors, it was



Figure 1. Blackett with scientists and military officers in Delhi, early 1950s.

very complicated. India was usually a secondary consideration to the great powers as the Cold War evolved, but was occasionally a sharp and pressing consideration. And as a stage on which to demonstrate another kind of development, India became rather central, both from the rivalrous view of the great powers, and for the Indian government which Blackett served.

It is difficult to give a measure of Blackett's influence in India. Blackett's papers in the Royal Society seem incomplete, and we do not have a thorough record of all of his activities in India. We cannot easily calibrate his experience in India with his other activities and relationships in the rest of his large life. In the 1967 interview he remarked 'I had no official status in defence matters except as an adviser to Nehru.' Since his reports were marked 'Secret', and his consultations were not widely known, it is understandable that his public reputation was largely in the field of scientific research institution building and not in strategic development. In tracing his relationships with key Indian figures and institutions, I often learned more about India than I did about Blackett. It is his appraisal of others, usually very decisive, that reveals most about him.

Blackett's father's brother was a missionary in India, his mother was the daughter of Sir Charles Maynard, an officer in the Indian Army around 1857, and his mother's uncle was a tea planter in Assam. Perhaps because of these associations, or in spite of them, Blackett had not really wanted to go to India before it achieved independence,

and though he was proud to be there during that great change, he was soon to discover both how old lines of dependence were maintained and new lines of interdependence were established. He was thus an early harbinger of the whole discourse on the proper role of science and technology in newly independent developing countries.

THE PROFESSOR AND THE PRIME MINISTER

He was a superb leader. But he did not know how to get things done very well.

(Patrick Blackett, 1967)

Few prime ministers at that time had the appreciation of science and scientists which Nehru did, precisely at the time when his prime ministerial influence in the Indian scientific community was profound. He was the direct Minister with portfolio—with powerful Secretaries (deputy ministers), one for atomic energy, the other for industrial research and natural resources. Nehru was intimately involved in a third and a fourth subject—defence and economic planning. He was also Minister for External Affairs. He kept these five files close to him, and met directly with the scientists responsible for them. The indirect evidence is that Nehru discussed many issues in his responsibilities with Blackett, judging from comments in letters written by Bhabha, Bhatnagar, Mahalanobis, Saha and others. Scientists and officers soon learned that one way to Nehru, and simultaneously to Bhabha or Bhatnagar, was through Blackett's ear. From 1948 onwards, Blackett usually stayed in the Prime Minister's Residence, often for weeks at a time. In 1948, his wife Constanza stayed with him. He received his correspondence and phone calls there. If Blackett became inspired about your project or problem, his energy knew no bounds. Blackett, of all people, believed in the possible. This must have appealed to Nehru.

During the years when Nehru was formulating the movement of non-aligned nations, he tried his ideas out on Blackett, who was very receptive to them and probably contributed to them. He spoke most approvingly of this part of India's foreign policy, and showed how India could not possibly win an arms race, not even with nuclear weapons. He said in 1967 'I think you [India] would have split up if you had to fall into the western orbit in the first five years of independence. I think it was [Nehru's] great contribution of showing that non-alignment is a thing that is feasible ... I did not think it was feasible at the time.'²

Blackett went on to say about Nehru that:

he had a bit too much intellectualism to solve the problem. He spent, from one point of view; too much time talking... He liked intellectual company. (And he did not get it except in Homi Bhabha and people like that.) He had extreme informality and charm; his physical presence was extremely attractive; he was very engaging, with a shy sort of smile. He was sort of light-hearted. I liked this about him. But he spent too much time, I think, on science anyway. Considering the amount he had to do, running a country of that size, the amount of time he did spend with us was indeed surprising. On the whole, he liked me and others more as companions than as consultants.



Figure 2. Patrick Blackett with Vijaya Lakshmi Pandit, Nehru's sister and also Ambassador to Moscow and Washington at the British Association Meeting, Dublin, in 1957. On the left is Lady Blackett. (Reproduced courtesy of the Irish Independent).

Although we know the close relation of Nehru and Blackett, we do not know its frustrations, or what value Nehru privately placed on his advice.

Blackett was candid about Nehru in 1967, saying:

He was a superb leader. But he did not know how to get things done very well. He believed in science in a rather naive way. We all did at the time. He was not more naive than other people. It was enormously valuable that he should put science first in making Indians scientifically minded. But science is only part of a game and the real effect of science comes from producing wealth... Now India is finding out that the problem of turning science into wealth ... is very much more difficult than just doing science. It is not his fault that he did not fully understand this... We were all scientifically naive. We thought science was the solution to everything. I do not think I was very conscious of it explicitly earlier in this period...

Blackett's deepest critique was about implementation and action:

Nehru did an enormous amount to get non-scientists to understand what was scientific. But his regime did not do nearly as well in implementation. What he lacked were hard-headed industrial-minded Ministers who could push on the agricultural program, the industrial program.³

PATRICK BLACKETT AND INDIAN SCIENTISTS

We were all scientifically naive. We thought science was the solution to everything. I do not think I was very conscious of it explicitly earlier in this period.

(Patrick Blackett, 1967)

Nehru did, of course, have two scientists as hard-headed Secretaries of his portfolios. They were not elected but had, as Secretaries to the Government, direct access to him, often more than any elected minister. They had Deputy Minister status. One was Homi Bhabha, the physicist whom Blackett first met at Cambridge in the 1930s, in charge of the atomic energy programme and the laboratories (including his own in Bombay), which were funded through it. Bhabha was an extraordinary man with his finger on the strategic pulse. At the time of his death in 1966 Blackett called him 'my best personal friend'. Blackett went to parties at Bhabha's house, had his portrait sketched by Bhabha, had Bhabha to stay at his own house (for example in 1946 in Manchester, before Blackett first went to India). The other powerful Secretary was Sir Shanti Bhatnagar, a chemist with training at the University of London, who was the head of the Council of Scientific and Industrial Research and who also reported directly to Nehru. The Council of Scientific and Industrial Research, of which Bhatnagar was the Director, paid for Blackett's first trip to India. With Sir Shanti, Blackett also formed an ongoing personal relationship, until Bhatnagar's early death in 1954. They had frequent meetings in London as well as in Delhi.

In addition, Blackett was friendly with Prasanta Mahalanobis, a physicist trained at Cambridge who became a statistician in Calcutta. Mahalanobis too had quasi-ministerial status, saw Nehru regularly and shaped Nehru's entire approach to economic planning, which we know was one of Blackett's continuing passions. At not quite so senior a level, Blackett's advice shaped the career of Daulat Singh Kothari, another Cambridge-trained physicist who became the Scientific Adviser to the Minister of Defence in 1948 and headed the Defence Science Organization when it was established in June 1949. This organization in Delhi was modelled on the one Blackett had just prescribed for the UK. Kothari eventually gained the most important position in the politics of education and universities in India. Together these men controlled larger budgets for construction and for employment than anyone else in the scientific community.

From the late 1940s, the scientists Blackett knew were travelling regularly; Bhatnagar to Norway to negotiate a heavy water deal, Bhabha to Ottawa to negotiate a reactor, Kothari to Moscow to purchase troop transport aircraft, Mahalanobis to Washington to look at the new large computers. As they passed through London they all kept in touch with Blackett. Blackett visited their institutes, gave lectures there, examined their doctoral students, helped select candidates for appointments, appraised new research programmes and then promoted them if he liked them. These same scientists were also friends with A.V. Hill, whose influence on science and the military in India began in 1943, well before Blackett's own relationships with that country. The Blackett friendship in some senses was an extension of the Hill friendship in the professional sense of advocacy within the scientific community. Hill knew Bhatnagar

very well, and advised Bhabha on the establishment of his own institute. As personal friends of Blackett's, these men also asked him to watch out for their children and other relatives when they studied or worked in London, which he did.

The relationship of Bhabha and Blackett was different from the others. They already knew each other well at Cambridge, where Bhabha (11 years younger than Blackett) studied under Paul Dirac. At a weekend conference in Manchester in 1937, Bhabha established himself in Blackett's eyes as an independent-minded physicist. In the company of Heisenberg, Bhabha (age 28) challenged Blackett (age 39), who insisted that the quantum theory of radiation must fail at higher energies because there could be no particles heavier than electrons in the penetrating component of cosmic rays at sea level. Bhabha persisted patiently in saying there is a penetrating component heavier than the electron. According to an observer, Blackett stubbornly resisted this idea at the conference, but a few months later conceded that an energetic electron could produce a cascade shower, according to the Bhabha-Heitler theory, and the penetrating component of cosmic rays must consist of a new type of particle with mass intermediate between the electron and the proton.⁴ Bhabha's international scientific reputation was already well-established before the war, and he wrote more openly to Blackett than he did to many others. For example, in 1941, Bhabha wrote to him from India that 'the attitude of the Government is as die-hard as ever. The mis-rule would astonish you.'⁵ A reluctant experimenter in physics, Bhabha preferred a more theoretical mathematical physics, but he liked the practical gleam in Blackett's eye, and was delighted when Blackett got the Nobel Prize in 1948 for work with the cloud chamber in the early 1930s in Cambridge. Bhabha made a commitment to cosmic ray studies in India from the late 1930s. He asked Blackett to lend him the big magnet Blackett built at Cambridge, for cosmic ray research in Bangalore in 1941, but apparently it was never sent. When Bhabha built the Tata Institute of Fundamental Research (TIFR) in Bombay, Blackett was in on every step. Every time Blackett came to India, often at someone else's expense, Bhabha would command part of Blackett's schedule, and arrange meetings for him, including introductions to the captains of industry with whom he was very well connected through the Tata family and other Bombay Parsi networks. Blackett could not have had more a powerful and effective set of intermediaries in India, nor a more secure base from which to criticize and challenge Establishment thinking. That some of his friends constituted part of the Establishment, and wanted similar changes within it, only enhanced his influence.

The most powerful person in science in India just before independence, Sir Shanti Bhatnagar, also was in a position to invite foreign experts to visit and work in India. At the 1946 Empire Scientific Conference, P.C. Mahalanobis and Bhatnagar proposed a scheme called 'Short Visits of Scientists From Abroad' and Mahalanobis followed up with a list (drawn up by people like Meghnad Saha), which included Robert Oppenheimer, Norbert Wiener and Niels Bohr, as well as familiar British names, Patrick Blackett, J.B.S. Haldane, Sir Henry Dale, Sir Henry Tizard and Joseph Needham. Nehru agreed to sign the invitations to give these visits prominence.⁶ It is probable that Blackett met some Indian scientists in London at the month-long Empire Scientific Conference in 1946. Eventually most of the individuals on this list came to

India and got involved—some more, some less—in the development of their field and its research institutions.

When Blackett received an invitation in 1946, signed by Nehru, he accepted. He was asked to address the Indian Science Congress (of which Nehru was President), and the Association of Scientific Workers of India. Blackett had been a committed member of this Association in Britain since the 1930s, and the objectives of the Indian Association were identical; to increase the applications of scientific rationalism in politics and planning, and to improve the working conditions of scientists. His old Cambridge colleague, and head of the Association in Britain, the physicist J.D. Bernal, was influential in getting the Indian Association recognized, but the impetus for its development came from India.⁷ During his 1947 visit, Blackett received an honorary degree from the University of Delhi, an event requiring months of planning and Blackett's foreknowledge. Evidently he decided to go to India in the autumn of 1946. It appears that while flying to the meetings of the Indian Science Congress in early January 1947, Blackett and Nehru found themselves on the same plane, and managed to talk.⁸ Shortly afterwards, Blackett went for lunch and talk at Nehru's home in Delhi. Much of Blackett's engagement in India resulted from those two conversations.

BLACKETT AS MILITARY CONSULTANT

On the whole I think my views about the Indian armed forces expressed in 1948 have not proved too incorrect.

(Patrick Blackett, 1972)

Patrick Blackett was proud of his involvement in military affairs in India, and appears to have gained considerable insight from the experience. A window opened for Blackett upon a new world of poor countries which were trying, like India, to build a scientific and technological community that applies its skills to socio-economic problems, as well as building up a modern military infrastructure. Although this is not something to which he appears to have given much previous thought, he threw himself into it in the 1950s. At the same time, I think he realized with regret that much of the effort of such countries was drained in the importation of costly weapons systems. Thus he argued that India should define very carefully what armed conflicts it would face, and should choose its weapons for those conflicts with equal care. He correctly realized that the military forces would be used in conflicts inside India, particularly after seeing the 1948 experience in Hyderabad and Kashmir. And he faced conflict in India between defence and science, and the need to address the imperative of the era, which was then, as now, to reduce poverty. The conflict of industrial and economic development with scientific and defence policy was unresolved throughout Blackett's period, but he seems to have become more conscious of it as he got older.

His advice ranged from the most concrete, like creating jobs and arranging for specific appointments, to a general concern for the development of a weapon such as the tank or an organization such as the Defence Science Organization. Then there is

his wider commitment to cultivating certain ways of thinking, ways we would now call 'systemic', to do with how systems operate and how they can be understood dynamically in the field. This wider commitment was explained in terms of strengthening Indian strategies for economic development, industry and defence. At the core of these strategies glowed Blackett's own holy grail, the pursuit of science in its purest, most difficult and most exciting form. He later reflected that he had not been conscious of the oversimplification in his approach to science and development, and began to rethink what he and his closest allies in India believed about science in the 1940s and 1950s. During this entire early period as military consultant, Blackett was actively promoting his own scientific projects in India. In 1948, he was already in transition away from the subject for which he won the Nobel Prize that year (cosmic rays) to the question of the reversal of the Earth's magnetism. He lectured on 'the origins of cosmic rays' and 'reversely magnetised rocks', and proposed projects on white dwarf stars. He supervised the collection of lava and rocks in India in the 1950s and 1960s for his project on geomagnetism. He presented—for his friends and for casual observers—a unique combination of the theoretical and the practical.

This combination was fully realized in his work as military consultant. It was A.V. Hill who involved Blackett in military research committees starting in 1936, and Hill and Blackett communicated frequently about new weapons and strategic questions prior to Hill's departure for India in 1943. Hill preceded Blackett as a military consultant in Delhi, when he spoke to the senior military staff in India in 1943 about the value of science and scientists, gave a lecture on operational research and reported on his appraisal of the situation to the Viceroy. When Lord Mountbatten needed scientific advisers in 1943 in Supreme Allied Command, Hill was instrumental in getting physicist J.D. Bernal and physiologist Solly Zuckerman to work for him, and Bernal spent the last weeks of 1944 in Calcutta, the Arakan coast of Burma and at the HQ in Kandy, Ceylon. Blackett, who slipped effortlessly between the naval and airforce 'camps' in the British military, already had long experience of inter-service competition when he served on defence committees. Despite being classified as a naval expert, he developed the 'Blackett bomb sight' (Mark XIV) that was standard equipment on Allied bomber aircraft. He had access to Ultra secret code material by November 1943.⁹ He debriefed the captured German nuclear physics team at Farm Hall, just outside Cambridge, in September 1945. He sat on the key committees (or talked regularly with people like Sir John Cockcroft, Sir Henry Tizard, Sir Rudolph Peierls and Sir James Chadwick who sat on committees) that bridged the public and secret uses of nuclear fission, and he knew everybody interested in other future weapons. Moreover, through this period he understood all the engineering required to apply fission to both weapons and power generation. In 1946, he received the US Medal of Honour for his work on the Mark XIV bomb sight, and in 1949 he travelled to the USA for extensive talks with scientists and strategic analysts in the context of publication of the American edition of his book on nuclear weapons.

It is his uncommon range of abilities and experience that made Blackett valuable to India, particularly his skill in the comparative analysis of military systems. Despite the chaotic changes going on around them, his friends in India correctly evaluated his

value to their objectives. In the period between 1945 and independence, Britain was preoccupied with many issues in India but scientific development was not really among them. As the end drew near, after his intensive meetings in India with members of the Atomic Energy Committee (Bhabha, Bhatnagar, Meghnad Saha) and Nehru in early 1947, Patrick Blackett briefed the Viceroy and Field-Marshal Auchinleck in Delhi, and Prime Minister Atlee, Sir Stafford Cripps and Lord Mountbatten (poised to be appointed to be the last Viceroy) in London. The subject of all these meetings was 'the atomic energy set-up in India', and it appears that he was also basically soliciting their commitment to assist his friend Homi Bhabha, whom Nehru had already identified as his champion of atomic energy and nuclear research.¹⁰

In 1945 and 1946, Blackett was on the subcommittee on future weapons for the Chiefs of Staff of the British armed forces. He chaired the Harwell Atomic Power Committee from May 1946, and was a member of the powerful Advisory Committee on Atomic Energy between August 1945 and April 1949, including after its renaming it to the 'Nuclear Physics Committee' in January 1948, when Chadwick became Chair and Blackett was Vice-Chair. Blackett was instrumental in having Tizard appointed to this Committee. Both Blackett and Tizard eventually took the position that the UK should not develop atom bombs, but should leave that project to the Americans and obtain some protective nuclear guarantee from them. This was not the position approved by Cabinet, and Blackett was identified again as an exception, as a non-conformist. He had to leave the Committee and return each of its documents. But Blackett was not just a physicist who understood nuclear strategy, he was also a naval officer with practical experience in war. In this he had something in common with the new Viceroy, Lord Mountbatten, with whom he would gradually become friendly. Blackett's meeting with Mountbatten on return from his first trip to India in 1947 was not a great success: 'I wish I had been able to see Mountbatten alone' he said, 'he was obviously much more sensible than Ismay but still disappointed me a bit. He seemed very keen on finding all the arguments on why India should remain in the Commonwealth. It may be that this will in the end happen, but to over-stress our desire for it to do so would seem to me a mistake.'¹¹ Blackett had been convinced, in January and February, by people in Delhi who said Britain should leave India within three months, not six or nine. This relationship between Mountbatten, Blackett, Nehru and India was to be important; if Mountbatten had not generally respected Blackett's work, he could have undermined his effectiveness in India. From the friendly letters they exchanged in 1971-72 it appears that Mountbatten maintained throughout a respect for Blackett's activities in India.

In 1967, Blackett reminisced, with characteristic confidence, about the experience of coming to India to try to influence the Defence establishment, and why he was selected:

Nehru spoke to all the scientists, but I was the only scientist there with professional military experience; five years at sea in the First War, and four years amidst the application of scientific methods to modern warfare. So it was not very accidental that Nehru chose me to advise him.¹²

Five years later he said, with continuing satisfaction, 'On the whole I think that my views about the Indian armed forces expressed in 1948 have not proved too incorrect.'¹³ Blackett's memory in 1967 was consistent with his first report in 1948. After the Indian conflict with China in 1962 and Pakistan in 1965, Blackett said that his effort from the beginning had been to prevent the unnecessary and costly introduction of weapons and strategies which would not have practical value, and to focus attention on the military risks which India did face. The most pervasive problem he faced was, Blackett said, that:

Indian officials and advisers were thinking purely from a Whitehall angle. There was an appalling psychological dependence on every word that Whitehall speaks. I understand in the beginning, in 1948, there was very little time and experience to think for yourself. But a great many of your problems are due to imitative adoption of Whitehall habits. Actually a lot of that thinking should not be exported anywhere. Some of it is not even good here.¹⁴

Blackett met with the Chiefs of Staff every time he went to India, and the Minister of Defence and the Minister's Scientific Adviser. He gave a talk to the Chiefs of Staff in the War Room each time, toured armaments and aircraft factories, appraised candidates for strategic analysis positions, interpreted strategic implications of the Cold War into Indian context. He got into the details of building tanks and developing rockets in India. He said, with great satisfaction in the 1967 interview, 'I like to think that ... I saved India a lot of money by discouraging her from buying too much big and expensive Western equipment.' He distinguished between the Indian and British military risks to which new weapons were to be the solution. For example, in 1948, he advised the British forces to follow a rapid programme to develop supersonic fighter planes, whereas for India he took a more cautious approach, and did not support integrated production of jet fighters in India until seven years later when he proposed a lighter, more versatile, transonic fighter based on an Anglo-Dutch model designed by people whose reputation he knew very well. 'Underlying Blackett's report is "the understanding that it is the intention to make India as nearly as possible a self-supporting defence entity as may be at the earliest possible date"', according to Abraham, who notes the remarkable similarities to the objectives of A.V. Hill's work during the war. 'Yet this understanding was neither invented by Blackett nor did it come from Hill. Blackett took the quotation on self-reliance verbatim from the Report on Defence Science (1946) written by Dr O.H. Wandsborough-Jones, a British defence scientist advising the colonial Indian government.'¹⁵

But more importantly for him, he forced Chiefs of Forces and Defence Ministers to define what kind of wars they expected to fight, who the probable enemies were and what the risks were. He gave shrewd appraisals of his first adversaries: the Admiral, with whom he disagreed over the Navy's future; the Air Marshall; and the Chief of Staff of the Army. Admiral Parry 'was a very nice man', said Blackett in 1967, 'but he tried to sell India, or make her buy four fleet aircraft carriers which would have required sixteen new destroyers to protect the carriers'. (These were light carriers of about 15 000 tonnes, then in great surplus, and being sold cheaply to friendly navies to raise money. Blackett might also have known that it was the Royal Navy's policy not to sell a carrier to India that year, because it felt that the Indian Navy was not ready

to maintain one. His advice, and the Royal Navy's position, coincided. This kind of carrier was eventually obtained by India and renamed INS *Vikrant*.) The chapter on the Indian Navy is the only subject on which there was Cabinet disagreement in India, and Blackett had to strengthen his argument by obtaining, from friends in Whitehall, secret estimates of costs of ships currently under construction by the Royal Navy in 1948. The military situation in India was quite volatile: Blackett had also probably heard about the near-mutiny in the Indian Navy in the previous year. Admiral Parry returned fire a few days after seeing Blackett's report: 'I personally think you are being unrealistic in your fundamental assumptions—particularly that India should only prepare for a local war against an imaginary opponent of comparable overall strength to herself.'¹⁶

The Airforce chief, Air Marshall Elmhirst, 'tried to make India buy long-range bombers' said Blackett, which would ruin India while being useless in local wars. Worse, he said, long-range bombers would have been dangerous to India, inducing massive and uncontrollable retaliation. For the Chief of the Army Blackett had more respect. General Bucher 'was less intellectual but wiser than the others. He was born and brought up in India, and understood what it was about, he knew the terrain. He immediately spotted that the arms salesmen were trying to sell us things like these tanks without telling us they were too big to cross our bridges.'¹⁷ It cannot have escaped Nehru's attention that it was very useful to have an expert like Blackett with a network in Whitehall to appraise the plans of India's defence chiefs with their own networks in Whitehall.

Blackett also discovered at first hand the postwar 'Colonel Blimp culture' surrounding India, which enraged him, and reported to Sir Stafford Cripps that he had just met General H.L. Ismay in 1947 with Lord Mountbatten in London. Ismay (who was also born in India, and would become Secretary of State for the Commonwealth in 1951) 'produced more "Blimpisms"', said Blackett, 'than I have heard from anyone for ages. He did not seem to me to have a clue as to the real situation in India. He just doesn't know the facts.'¹⁸ Blackett had experienced this culture at closer range, a few weeks before, when he joined an expedition which had been planned for bird watching but which (in anticipation of Blackett's being unable to join in) was changed for bird shooting. In the end, Blackett (not sympathetic to shooting birds) joined the expedition.

I was invited by a British General, who was a friend of mine... We drove out some 20 miles from New Delhi and then looked for partridges by drawing a rope across the top of a small sugar field. The villagers soon came along, all with their Gandhi caps, to protest against the party shooting in their fields, without even asking permission—adding that the last shooting party had shot a peacock, which of course are sacred birds. This is what was translated to us. The leader of the shooting party told the villagers that they were not harming the crops and they had no intention to shoot peacocks. The villagers looked surly but did not protest any further. Later in the afternoon the shooting party was driving slowly along an irrigation dyke when a peacock was seen on the dyke about a hundred yards ahead of the cars. The leader of the shooting party stopped the car, jumped out and raised his gun. But before he had fired an Indian woman walked up the bank of the dyke between the car and the peacock. The leader lowered his gun and said 'what a bore, now we won't have peacock at the Club tomorrow'. Two years later at a cocktail party in New Delhi I was introduced to a man whom I recognised as the leader of the (to me) memorable shooting party. He is a British diplomat. This [incident

on the dyke] was [in] January 1947, at a time of acute civil disturbance and with the end of the British Raj only a few months ahead. One would have thought that all Britishers would have been on their best behaviour. Was the shooting party typical of the heyday of the British Raj?¹⁹

In his 1948 Report to the minister of Defence, Blackett listed those weapons which should not be on India's list for development, as follows: atomic weapons, chemical warfare, supersonic jets, high-performance jets and guided missiles. All of these were unsuitable, he said. At the same time Blackett grasped from the beginning what not all Indians or British realized—that despite 200 years of a deeply intertwined military development, British forces were unlikely to play any further role in conflicts involving India, and that foreign troops/equipment were unlikely to be based in India. Blackett soon saw Indian troops deployed inside India, in Hyderabad and Kashmir. Nehru wrote to Blackett to thank him for his work, to praise the Indian military success in Hyderabad, and to say that the war risk over Kashmir had subsided: 'I think definitely that there is hardly any chance of war between India and Pakistan. Of course the Kashmir issue remains and it is a difficult one.'²⁰

Blackett says he gradually elaborated a theory of marginal war, preparing India for war with a country the size and force of Pakistan, and not with Russia or a Western power. He did not mention China. 'The Pakistan war (of 1965) was an exact example', he said in 1967, 'countries of similar make-up fought each other to a stand-still, more or less.' He tried constantly to inhibit the Indian attraction to grandiose military projects. By 1949, he had gained the glow of a Nobel Prize, something he did not have on his first two visits in 1947 and early 1948. He had also been told, in 1948, he was *persona non grata* in the USA, and was later detained by US officials when his Canadian plane refuelled briefly in Florida in 1950. This may have added to his stature in India, where there was a camaraderie among and respect for those who spent time in the prisons of a well-known 'big power'. It is a measure of the Cold War that Blackett was awarded the Medal of Honour by the USA in 1946 and quietly declared *persona non grata* by the USA in 1948. The change in the international climate was equally dramatic: Churchill's 1947 'Iron Curtain' speech in the USA provided a figure of speech to conjure the new state of affairs. The USA sought to install a virtual monopoly of knowledge surrounding atomic energy and weapons. On the Western front in 1948, the Berlin Blockade posed again the risk of a war in Europe between the Allies and the Soviets. In 1949, the Chinese communist revolution was successful and the USSR tested their first atomic bomb in August. India was now being taken a bit more seriously. Over the next five years, Nehru articulated his policies of non-alignment, trying to build enduring relationships with South-East Asia and China. Meanwhile India gradually became dependent on the Americans, so that Nehru was already discussing loans for food and steel shipments for India with the USA and Canada in 1949. The Indian Ambassador in Washington had prepared the ground for Nehru, and the US Ambassador in Delhi wrote a formal request for five years of economic assistance. Nehru did not like the conditions which he expected the USA to put on these loans, and did not pursue the request vigorously during his 1949 visit (in part because he found his relation with President Truman and Secretary of State

Acheson so difficult). But the signal had been sent, and grain from Canada and the USA eventually began arriving in 1950–51, after prolonged official negotiation.²¹

The atmosphere surrounding Blackett's work for Nehru in 1948–50 was turbulent. Indian scientists like Bhabha, Bhatnagar and Kothari were thrown into work that had immediate strategic implications. Through their contacts with Patrick Blackett and the establishment of a defence research organization, they worked in a more conflictual world, particularly after partition and the military operations directed by the Indian Army in 1948. No longer did foreigners direct these activities, but Indians. Less than a year after independence, a young Hindu zealot assassinated Mahatma Gandhi in his garden in Delhi, creating a martyr and settling a leadership question; the people who surrounded Nehru would now be fully in charge. The rootedness of Gandhi, and of many of his followers, became a progressively more nostalgic force; Nehru's cosmopolitan, patrician and elitist leadership was without serious challenge, even from the Hindu extremists who privately approved of partition and Gandhi's death. The partition and Gandhi's assassination were a vast and dramatic opening and closing of possibilities.

Concerned about the costs of licensed defence production, and about capturing benefits in India and elsewhere from Indian innovations, Blackett asked Shanti Bhatnagar in 1948 to provide him with a list of all patents held by Indians which might be applicable to defence production. In 1950, Bhatnagar sent all 'the various projects which have been patented, exploited, or under consideration for exploitation.'²² He then began to examine productive facilities. His tours of armaments factories were an observational displeasure. He recalled a factory set up north of Bombay by the Swiss arms manufacturer Oerlikon:

absolutely four million pounds went down the drain. India did not want new prototype weapons like Oerlikon did, Indians wanted to manufacture existing weapons. The factory had some refugee-Germans trying to invent recoilless guns, under the charge of a charming ICS [Indian Civil Service] man who had been to Oxford and who did not know anything about machine tools in the first place.

In 1967, he went on, 'You ran your Bangalore electronics factory down. It is running all right now. But it took ages to get it going, because the people in charge had no knowledge of it. One of the Defence Minister's followers was a poet. He was so embarrassed. He did not know one machine tool from another.' Don't misunderstand me, Blackett said elsewhere, 'I am deriding my civil servants just as much. They thought they could run anything, being at Oxford.'²³

As part of 'Indianization', Blackett immediately advised Nehru to establish a new research function within the Ministry of Defence. Until this time most research had been carried out in Britain. There were a few Technical Development Establishments under the Indian Army with the purpose of providing inspection and quality control in ordnance factories. Although the officer corps were well trained and educated, scientists and engineers were not involved. A few weeks after giving his first major report to Nehru on defence in 1948, Blackett wrote to the Minister of Defence, 'I am delighted with your choice of Dr Kothari to be Scientific Adviser to the Defence Ministry. I am in complete agreement with his views on these matters.'²⁴ Daulat

Singh Kothari, whom he helped to become the Scientific Adviser to the Minister of Defence and who thus headed the new Defence Science Organization, had first met Blackett in the Cavendish Laboratories in Cambridge in the early 1930s. Trained by Saha at Allahabad, Kothari was a theoretical astrophysicist who had seen how Rutherford's experimental laboratory was organized, and how stars in it like Blackett functioned. This new Defence Science Organization in Delhi was modelled on the one Blackett had just prescribed for the UK. Since it was first housed in the new National Physical Laboratory (of the CSIR), and borrowed scientists and equipment from it, there was around 1950 a deep integration of personnel in defence research and industrial research. The close relationship between Bhabha, Bhatnagar, Kothari and Blackett—and all of them with Nehru—reinforced the structural advances of such integration. Kothari now joined the group of science developers who had institutes to build and positions to fill: within months of starting, Kothari received a letter from his revered teacher Meghnad Saha enquiring about a job in defence research for one of his sons.²⁵ By 1951 Blackett was channelling all Indian requests for employment (on defence matters) directly to Kothari. In 1953, for example, Bhabha heard of Blackett's visit to Delhi and phoned Kothari from Bombay to ensure adequate time was set aside for a visit to the TIFR in Bombay. Kothari then informed Meghnad Saha and P.C. Mahalanobis in Calcutta of Blackett's visit to the TIFR, and they immediately wrote to Blackett to have their institutes put on the itinerary.

Blackett decided to intervene in training; having overseen the creation of a Defence Science Organization, in 1950 he urged creation of functional groups, such as the Weapons Assessment Team and the Operational Research Group. By 1951 he was clearing the way for defence scientists to spend a year at Cambridge and in the UK Operational Research Group. He also acted as intermediary for the appointment of the first Director of the Indian Institute of Armament Studies, a Briton who was previously at the RAF College. At that time Blackett and Kothari discussed a Naval Research Laboratory for Bombay. Although Blackett wanted a focus on real problems, he also said from the beginning (to the Minister of Defence):

It is most important to realize ... that a research and development establishment must often keep a considerable number of its personnel employed on work which promises no immediate or tangible results.²⁶

In the years following independence there were immediate pressures on Indian leaders to face the new (and uncertain) position of the country in a hardening cold war environment. Blackett understood this environment as well as anyone else, although his interpretations of it were unconventional. After the 1948 Berlin Blockade was broken, attention turned in August 1949 to the Soviet atomic bomb tests and the success of the Chinese Communist Party in taking full control of China. The Allies, confused by events, realized with chagrin that their efforts in China had been futile and were chastened to admit that even the most rigorous controls on information had not stopped the Soviets from developing their own atomic bomb. Although French and Dutch military forces had been fighting unsuccessfully in Indonesia and Vietnam to preserve their colonial territories, the march of North Korean and Chinese troops into

Seoul in 1950 decisively opened Allied eyes to the risk to their interests in Asia. India began to be taken slightly more seriously, particularly its policy of non-alignment. The Indian ambassador and then Nehru himself discussed possible loans for wheat and steel with the Americans in 1949. President Truman's response was that India should apply to the World Bank (IBRD). Following this US rejection, Nehru then suggested to Krishna Menon (High Commissioner in London) 'why not align with the US somewhat and build up our economic and military strength?'²⁷

As a confidante of Homi Bhabha, Shanti Bhatnagar and Nehru, Blackett understood what the Indians were doing in atomic research from the beginning, and he thus sometimes avoided explaining this publicly. Since 1944 the security of India's fissile minerals had been a quiet theme in Anglo-American politics. In 1951 the story emerged in Washington that President Truman had made an explicit connection between a new 'Grain for India' plan and the fact that India held three-quarters of the world's monazite/thorium. As it was known in London which person understood the implications of this connection, the Editor of the *Daily Telegraph* phoned and wrote to Blackett asking for an interview. Usually ready to talk, Blackett's disingenuous reply was 'I have nothing to tell you which would be of use to you nor do I have any comment on the report.'²⁸

By this time, although Bhabha was regularly meeting his official counterpart and old Cambridge friend Sir John Cockcroft, Director of the Atomic Energy Commission, he could always get another view from Blackett, whom he met at least twice a year and usually more. Blackett helped Bhabha indirectly too. For example, he met the scientific attaché to the Indian High Commission in London in 1951 who, Bhabha said, was 'studying the organization of institutions where nuclear and atomic research is in progress.' Since Blackett would have known that this survey, which the UK AEA treated very cautiously, was being done for Bhabha and Bhatnagar, he gave his views on the proper organization of an atomic R & D system.²⁹

Committed to atomic energy, and opposed to atomic bombs, Blackett never lost sight of the importance of conventional weapons. He wrote to Nehru in 1951, gently promoting Kothari's influence, 'I have heard from Kothari that he is carrying on energetically the investigations we started on tank and anti-tank gun performance.'³⁰ At the same time, however, Blackett was talking to people in London about new weapons such as rockets, as he did with H.A. Sargeant, Deputy Scientific Adviser for the Army Council in the War Office, Whitehall. 'Kothari's group', reported Sargeant, 'is certainly making great strides, and I think there is no doubt that when you next come you will be impressed. My feeling is that they must now think in terms of specific Indian problems rather than copying the problems of other nations.'³¹ This was the very problem which Blackett was striving to address—he perceived an Indian predisposition to adopting the solutions developed elsewhere to problems which were not theirs. Nevertheless, Blackett was supportive of new initiatives such as rockets, which did not have to be British: 'when I was there at Christmas the Minister was particularly keen on a French rocket weapon which sounded very good.'³²

Notwithstanding his proximity to the Indian High Commission in London, and his meetings with Krishna Menon, Nehru's adviser on foreign and military policy, there

is an absence of correspondence between Blackett and Menon in the Blackett papers. This suggests that they met frequently enough (or read accounts in newspapers) to know each other's views, but that they did not develop a close or trusting relationship.

According to Blackett, one personal military planning triumph occurred in 1955. It was an application of the principle which his friend Homi Bhabha was following in atomic energy, namely to decide on the appropriate technology, to import a prototype and get training in production, and set about producing the technology in India. Blackett realized that since he was engaged not only in weapons evaluation, but also in the merger of defence policy with industrial policy and macro-economic policy, these economic, social and military objectives would be in conflict. He understood that planning had to take into account such conflict. Blackett was just learning about the socio-economic and political complexities of India. Having seen the use of Indian forces within India (Hyderabad, Kashmir), Blackett had to think strategically about kinds of conflict he had not seen before. It is important to remember the strategic context of the time. In 1954 and 1955 friendship treaties had been concluded and visits exchanged between both China and the USSR and India. The Soviets 'expressed a willingness to sell advanced military aircraft' to enhance their commitment to build a steel mill in India.³³ Note that the first MiG fighters actually arrived in India in 1963, after India's conflict with China. And Nehru was at the height of his non-aligned strategy, chairing the Bandung Conference on non-alignment just before the Gnat fighter deal was initiated between India and Britain. This was the year that India increased the size of its dollar reserves and proposed cutting the rupee from sterling and following an independent exchange rate policy. Fearing 'a break in a uniform sterling front and damage to the international role of sterling' (and critical of the increase in dollar reserves), the Bank of England and the Chancellor of the Exchequer pleaded with India not to present its proposal to the Commonwealth summit meeting. There was, at the same time, speculation on the pound and thus a sharp fall in the value of Indian sterling reserves which were still very healthy, at £542 million.³⁴ So for political and economic reasons Britain should have been very pleased with Patrick Blackett's influence as a military consultant in the Gnat contract.

The triumph Blackett alluded to concerns jet fighters. The Indian Air Force already had a Vampire fighter, constructed from airframes built in Bangalore, and imported British engines. Like others, he proposed an aeronautical research and development establishment from the beginning, 'if India is to build an air industry'.³⁵ But in 1955, Blackett's proposal was radical and risky: to start building a fighter much lighter than the Vampire and to build both the airframe and the engine. The choice, argued Blackett, should be the Gnat, a transonic aircraft with a ceiling of 50 000 feet and thrust of 4800 lb compared to the Vampire's 3300 lb. It was easier and cheaper to manufacture than alternatives, thus giving (said Blackett) two Gnats for every conventional fighter, and more quickly. The catch was that it had not been combat-tested. Blackett later said that although the Gnat was still not fully operational, its designer came to Delhi

and made a very convincing argument which eventually convinced most present including myself. In fact I became a very strong advocate for going into mass production before waiting for the full tests of the Gnat had been carried out: this meant gambling on the outstanding ability of Petter as designer and Folland as Chief Engineer.³⁶

The discussions about the jet fighter ‘often became vehement’, said Blackett, ‘I think that the majority of service pilots were against the Gnat but there was strong enough support from some of the technical staff at the Ministry to win the case eventually.’ (The Scientific Adviser’s Report described the Gnat as ‘severely utilitarian’, which might have been unattractive to pilots who wanted something fancy.) India was stepping into a zone of high uncertainty, said Blackett:

one has also to recognise the fact that during these days of terrific rate of development in fighter-aircraft, it is very difficult to forecast what current types would actually (if ever) find their use in war. Many types would never see war. They would, however, have served the purpose of leading to more effective successors, eventually leading to the nth successor which sees battle.³⁷

Here Blackett the planner triumphed, arguing that the Hindustan Aeronautics Limited programme ‘should consist of items which are a requirement for the Services (or better still for the Services as well as civil aviation), and which are within its technical reach and resources’. Blackett later took pride in the report that instead of heavier and more sophisticated aircraft, the Gnat performed very well in both wars with Pakistan in 1965 and 1971, and, he noted wryly, ‘it never became an important aircraft in the Royal Air Force’.³⁸ The Gnat did, however, become the main jet training aircraft for the Royal Air Force.

Not all his advice was accepted, however, following the success of the Gnat deal. Blackett recalled

another occasion when I think a wrong decision was made. This was the plan to bring to Bangalore Dr Tank, who was famous in the last war for his brilliant German fighter designs. The plan was that Tank should design a quite new supersonic fighter which would be designed, manufactured and tested in India. I was strongly against this as I thought it too big a step from a simple trainer designed and built at Bangalore to a supersonic fighter. My views were not accepted. This project was a very big one. A few such aircraft were made but I did not hear of their use in either of the two Pakistan–India wars.³⁹

Here Blackett is misinformed, because the fighter which Kurt Tank developed (called the HF 24) played a significant role in the 1971 war between India and Pakistan.

After revelations of the unprepared and ill-equipped state of military forces during the 1962 conflict with China, and the subsequent resignation of Krishna Menon as Minister, there was a complete review of Indian armed forces. Blackett’s knowledge of the past was now useful again, and in the context of a letter on the progress of cosmic ray studies, Bhabha wrote, ‘I hope you will agree to take on the job of reviewing our Defence Research Organization, if asked to do so later.’⁴⁰ In 1967, Blackett said that his military consulting declined as time went on, but I notice that he still had an Admiral of the Navy included in a dinner party given for him at the High Commissioner’s Residence in Delhi in 1965 (plus the Secretary to the Cabinet), and that he was asked to read a confidential report on precision optical manufacturing (with

military applications) in 1966. By this time, of course, he was President of the Royal Society, and thus very busy. But he kept up his study of Indian scientific and military institutions, and continuously used his influence to improve conditions for doing research. He formed a long friendship with General J.N. Chaudhuri, whose command of Indian forces at Hyderabad in 1948 Blackett had admired (there is a letter in Blackett's papers showing this, written much later). I recall being asked by General Chaudhuri at McGill University in 1971 whether I had talked with Sir Patrick Blackett about science and scientists in India, and if not, that I should do so quickly; 'he knows the facts', said Chaudhuri.

This account of Patrick Blackett's work for the military in India up to approximately 1964 reveals something that was not widely known. Although his presence in India was always public (as a person he physically towered over the stature of most of his hosts), and although some secrets are not easily kept in India, the other work he did with scientists took on greater importance. So while his military persona was not at all clandestine, a physicist who won the Nobel Prize and who circulated mainly among scientists and intellectuals naturally acquired a reputation for development of science. On the basis of evidence available so far, I do not think that the period during which Blackett worked as scientific intervenor was a camouflage for Blackett as military adviser. It is his work among scientists and scientific institutions that forms the subject of the second and following part of this essay.

VISITS BY PATRICK BLACKETT TO INDIA

According to his note in the Blackett Papers, Royal Society, Patrick Blackett visited India in 1947, 1948, 1950, 1953, 1954, 1955, 1963, 1964, 1965, 1966, 1967 and 1971.

Institutions visited (usually many times)

Universities (Delhi, Bombay, Calcutta, Madras, etc.); Tata Institute of Fundamental Research, Bombay; Saha Institute of Nuclear Physics, Calcutta; Indian Institute of Science, Bangalore; Indian Statistical Institute, Calcutta; Physical Research Laboratory, Ahmedabad; all Laboratories of the Council of Scientific and Industrial Research, e.g. Glass and Ceramics, Metallurgy, Roads, National Physical Laboratory, National Chemical Laboratory, National Aeronautical Laboratory, National Metallurgical Laboratory; all Defence Laboratories and all Defence Production sites.

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major published study of Blackett is by Sir Bernard Lovell, *P.M.S. Blackett—a biographical memorial*.⁴¹ I am grateful to Professor Lovell for conversations with him on this subject. Two conferences on Blackett in 1998, one by the Royal Society at Imperial College, London, and the other by the Royal Navy at Magdalene College, Cambridge, have benefited me enormously, and I gratefully acknowledge the insights and information which I received there, including those from Nicholas Blackett and Giovanna Bloor. For further information see the collection of essays about Blackett to be edited by Peter Hore (forthcoming). This research was completed while I was Visiting Fellow at Corpus Christi College, Cambridge. This essay is necessarily work-in-progress: there may be other unseen documents and letters that (if known) may change or contradict the picture drawn here. I alone am responsible for the interpretation I have made.

NOTES

- 1 P.M.S. Blackett, interview (in London) with B.R. Nanda of The Nehru Library, Delhi, 27 July 1967; Royal Society Archives, transcript p. 4.
- 2 1967 interview, Royal Society Archives, transcript p. 6.
- 3 1967 interview, Royal Society Archives, transcript pp. 4–5.
- 4 B. Lovell, 'Bristol and Manchester—the years 1931–1939, in *The making of physicists* (ed. R. Williamson), pp. 158–159 (Bristol, Adam Hilger, 1987). About Bhabha's relationship with Heisenberg, see D. Cassidy, *Uncertainty: the life and science of Werner Heisenberg* (New York, W.H. Freeman, 1992).
- 5 H.J. Bhabha to P.M.S. Blackett 1941, Royal Society Archives, Blackett Papers (PB).
- 6 P.C. Mahalanobis to S.S. Bhatnagar, 28 August 1946, NISTADS Archive, Delhi.
- 7 On the history of the Association in Britain, but without mention of its Indian counterpart, see G. Wersky, *The Invisible College: a collective biography of British scientists and socialists of the 1930s*, 2nd edn (London, Free Association Books, 1988).
- 8 I. Abraham, personal communication, 9 February 1999.
- 9 A number of essays about Blackett's role during the war will appear shortly in a volume to be edited by Peter Hore, based on presentations at two conferences in 1998.
- 10 P.M.S. Blackett to S. Cripps, 17 February 1947 and 11 March 1947, Blackett Papers, Royal Society Archives.
- 11 P.M.S. Blackett to S. Cripps, 11 March 1947, Royal Society Archives.
- 12 1967 interview, Royal Society Archives, transcript p. 4.
- 13 P.M.S. Blackett to B.R. Nanda, 8 February 1972, Royal Society Archives, Blackett Papers (PB), G.12.
- 14 1967 interview, Royal Society Archives, transcript p. 7.
- 15 I. Abraham, *The making of the Indian atomic bomb: science, secrecy, and the postcolonial state*, p. 56 (London, Zed Books, 1998).
- 16 Admiral Parry to P.M.S. Blackett, 7 September 1948, Royal Society Archives, Blackett Papers (PB), G.6.
- 17 1967 interview, Royal Society Archives, transcript p. 7.
- 18 P.M.S. Blackett to S. Cripps, 11 March 1947, Blackett Papers, Royal Society Archives.
- 19 N. Blackett, personal communication, 5 October 1998, including a copy of a letter typed shortly after the event.
- 20 J. Nehru to P.M.S. Blackett, 26 September 1948, Royal Society Archives, Blackett Papers (PB), G.5.

- 21 R. McMahon, *The Cold War on the periphery: the United States, India, and Pakistan* (New York, Columbia University Press, 1994).
- 22 S.S. Bhatnagar to P.M.S. Blackett, 29 December 1950, Royal Society Archives, Blackett Papers (PB), G.6.
- 23 1967 interview, Royal Society Archives, transcript p. 8.
- 24 P.M.S. Blackett to Baldev Singh Minister of Defence, Delhi, 30 September 1948, Royal Society Archives.
- 25 M.N. Saha to D.S. Kothari, 21 July 1948 Saha Institute Archives, Calcutta.
- 26 P.M.S. Blackett, Report to the Minister of Defence, 10 September 1948, Royal Society Archives.
- 27 R. McMahon, *op. cit.* note 21, p. 49.
- 28 P.M.S. Blackett to L. Bertin, 24 February 1951, Royal Society Archives.
- 29 High Commission for India to P.M.S. Blackett, 18 August 1951, Royal Society Archives.
- 30 P.M.S. Blackett to J. Nehru, 31 January 1951, Royal Society Archives, Blackett Papers (PB), G.5.
- 31 H.A. Sargeant to P.M.S. Blackett, 9 May 1951, Royal Society Archives, Blackett Papers (PB), G.7.
- 32 P.M.S. Blackett to H.A. Sargeant, 29 May 1951, Royal Society Archives, Blackett Papers (PB), G.7.
- 33 R. McMahon, *op. cit.* note 21, pp. 219–220.
- 34 G. Balachandran, *The Reserve Bank of India 1951–1967*, p. 617 (Delhi, Oxford University Press, 1998).
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- 36 ‘A note prepared by the Scientific Adviser on the visit of Professor P.M.S. Blackett—27 December 1954 to 15 January 1955’, and Patrick Blackett, aide memoir, (typed, undated—probably 1972), Royal Society Archives.
- 37 ‘A note prepared by the Scientific Adviser...’ 15 January 1956, Royal Society Archives.
- 38 Patrick Blackett, aide memoire (typed, undated—probably 1972), Royal Society Archives.
- 39 *Ibid.*
- 40 H.J. Bhabha to P.M.S. Blackett, 3 August 1963, Royal Society Archives, Blackett Papers (PB), G.33.
- 41 B. Lovell, *P. M. S. Blackett—a biographical memorial* (London, The Royal Society, 1976).